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[Third Edition.]

BUREAU OF EDUCATION

I. OUTLINE OF
A YEAR'S COURSE IN BOTANY

II. KEY TO THE
FAMILIES OF VASCULAR PLANTS IN
THE PHILIPPINE ISLANDS

EDWIN BINGHAM COPELAND

MANILA
BUREAU OF PRINTING
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INTRODUCTION.

The accompanying outline suggests the extent and arrangement of a year's work in botany for students advanced enough to approach it as a science (first year secondary). It is intended for the use of teachers, who are assumed to already know the subject-matter of what they are to teach. Where the text is slightly amplified, or definitions are given, it is to assist the teacher in the arrangement of the subject.

The best text-book available for use in this course is the *Principles of Botany* by Bergen and Davis; but close adherence to this book would rob the course of life. For the Filipino students, with their predilection for verbal memorizing, the absence of an authoritative text is not altogether a disadvantage. They need nothing more than to learn to study what can not be learned by rote. Plants are the material for the study of botany.

The teacher will use his own judgment in the stress put on each part of this work, but no part should be entirely omitted.

In the Normal School the distribution of the work, by weeks, is about as follows:

Seed	2
Root	3
Stem	3
Leaf	4
Algæ and fungi	4
Bryophytes	1
Pteridophytes	4
Gymnosperms	1
Flower and fruit	1
Individual angiosperms	14
Variation and selection	2
Total	39

If it is equally convenient to begin with roots, the study of the seed can better be taken up later with that of the fruit. The plants listed for subsequent study may well be the material on which flowers and fruits are studied. The presentation of natural selection at the end is merely as a summary; it should be made the student's point of view throughout the course. The utmost care should be given at all times to the notebook; for reviewing, it should be an adequate text. Each student should prepare an herbarium of at least 50 species, well prepared, and determined to the family.

As far as is now possible, local material has been suggested. In other years with experience in using what can be found, it should be possible to make almost exclusive use of local material, not only for laboratory study, but also for illustration.

Every school should have a collection of material illustrative of the adaptations and uses of plants. No other schools in the world can so easily make a fine collection of this sort, with the great advantage that it will have local interest. Every school should also have as complete as possible an herbarium of the local flora. This is especially necessary, in the absence of comprehensive "floras," with which the plants can easily be determined. The herbaria can be built up rapidly by the activity of the schools. Collections can be sent to this Bureau, and will be determined promptly at the Normal School or the Bureau of Science. Determinations will be returned to the schools sending the collection by *number*, to be applied to a duplicate set retained by the school. Several specimens of each plant should be sent, and any surplus will be given to other schools. A key to the families of Philippine vascular plants accompanies this outline. Of the families, the descriptions of the genera and species of *Polypodiaceæ*, *Compositæ*, *Rubiaceæ*, and *Gramineæ* have been published by the Bureau of Science or in Elmer's Leaflets, and *Myrtaceæ* and the remaining families of *Filicineæ* will follow soon. In this way a start is being made on the much-needed Insular "Flora."

I. OUTLINE OF A YEAR'S COURSE IN BOTANY.

GENERAL DEFINITIONS.

Botany is the science that treats of plants.

Science is the classified knowledge about any subject.

Plants are living things, which are typically green, possessing a green pigment, chlorophyll, which absorbs certain rays of the sun's light; these rays furnish the plant energy with which it breaks CO_2 into oxygen and carbon, the carbon being retained and used as part of the plant's food; as the plant's source of carbon, CO_2 , is everywhere, the plant need not move to seek food, and is stationary; and its stationary habit permits it to protect itself with hard, rigid walls of cellulose.

The science of botany can be divided in several ways.

It may be general or special.

General botany treats of plants as plants, with special regard to the common features of all or many plants.

Special botany treats of individual kinds of plants, their structure, behavior, or names, usually emphasizing the differences between the kinds of plants.

It may be morphological or physiological.

Morphology is the study of the form and structure of plants or their parts; from the standpoint of morphology a part of plant is a "member," of interest for what it *is*.

Gross morphology treats of the parts into which whole plants are evidently divided; the primary members of a plant are—

The root.

The shoot.

The stem.

The leaf.

Anatomy, or inner morphology, treats of the finer structure of plants, of the elements which recur in all the primary members.

The unit of plant structure is the cell. A cell may be a whole plant; or a plant may be composed of many similar cells; all higher plants are composed of many cells of many kinds. The branch of botany treating especially of cells is cytology.

Cells of common origin which are substantially alike constitute a tissue. The branch of botany that treats especially of tissues is called histology.

Physiology is the study of the activity or function of plants or their parts; from the standpoint of physiology a part of a plant is an "organ," of interest for what it *does*.

For the sake of universal uniformity and permanence, the names of plants are expressed in the Latin language. The name of every plant consists of two parts, a generic name, corresponding to the family name of a man, and a specific name, following the generic, corresponding to the man's Christian name. To these the name of the man who named the plant should be added.

A single kind of plant is a species.

A genus is a group of related species; it is the largest group of plants whose name is part of the name of the plant. A single species constitutes a genus, when it is without near relatives.

THE PLANT CELL.

Parts of cell. Trichome of Cucurbita or Lagenaria.

Wall. Cellulose.

Protoplasm.

Cytoplasm.

Nucleus; nucleolus.

Plastids; leucoplasts; amyloplasts; chloroplasts.

Inclusions. Starch.

Vacuole; cell-sap.

Inclusions. Raphides.

Growth of cell.

Cell-division.

Division of nucleus.

THE SEED.

Its parts.

The seed coats, outer and inner. Hilum, raphe; aril, micropyle.

The endosperm, sometimes wanting.

The embryo.

• The plumule.

The cotyledons.

The hypocotyl.

The radicle.

Arrangement of parts of seeds.

Orthotropous, Cocos.

Anatropous, Ricinus.

Campylotropous, Phaseolus.

Absorption of water by seed; rapidity and force.

The food store in seeds.

Where stored.

Kinds of food.

Starch, abundant in rice.

Cellulose, in Areca.

Oil, abundant in Cocos.

Proteids, evident in Ricinus.

Germination of seeds: Rapidity, and influence of external conditions.

THE ROOT.

The root is the part of the plant which grows in general downward, and whose functions are to fasten the plant in its place and to absorb water and other food dissolved in water. The most conspicuous structural characteristic of roots is the presence of the rootcap.

Root system. Primary, secondary, and adventitious roots.

Growth of roots.

Rapidity. Length of the growing region.

Direction.

Influence of gravity—

On primary root.

On secondary roots.

Influence of moisture.

Influence of light.

Anchorage of plant.

Taproots: Pinus, radish.

Large secondary roots: Most broad-leaved trees.

Numerous small adventitious roots: Palms, Musa.

Structure of roots.

Rootcap. Structure, size, functions: Pandanus, Cyperus.

Tissue systems; groups of tissues having common origin and position and continuous throughout the plant.

Epidermal system.

Epidermal cells.

Root hairs: Location; abundance; when wanting; function; fate.

Fibro-vascular system.

Xylem rays. Structure of tracheæ. Proof that they are the main water-conducting elements.

Phloem. Sieve tubes; function.

Pith.

Pericycle.

Fundamental system.

Cortical parenchyma. Hypodermis of Cocos.

Endodermis. Its thickness: Canna.

Absorption by roots; demonstration in water culture.

Turgor of roots. Dependence of absorption on turgor.

Reduced roots are those which have wholly or partly lost the functions of typical roots, and have undergone a correlated simplification of structure: roots of parasites. *Cassytha*, *Loranthus*.

Metamorphosed roots are those modified in form or structure to adapt them to the performance of other functions than those of typical roots.

Supports for stem: Banyan (*Ficus*).

Braces: *Rhizophora*, *Mais*, *Pandanus*.

Clinging roots of some vines: *Hedera*, *Pothos*.

"Hooks" of *Calamus*.

Food reservoirs: *Dioscorea*, *Manihot*.

Spines: *Acanthorhiza*, *Hydnophytum*, *Dioscorea* sp.

Pneumathodes or breathing organs: Mangroves, *Cocos*, *Jussieua*, *Pandanus*.

Floats: *Jussieua*.

To absorb water from air: Orchids with velamen.

To hold water: *Antrophyum*.

Organs of assimilation: *Taeniophyllum*.

Metamorphosed root cap: *Pistia*.

Root tubercles. Fixation of nitrogen. *Mimosa*, *Phaseolus*.

Rhizoids. Simpler structures, performing the functions of roots for lower plants; usually hair-like.

Rootless plants: *Corallorhiza*, *Wolffia*, *Salvinia*, *Hymenophyllum*, *Psilotum*.

THE STEM.

The shoot is the part of the plant which typically grows upward into the air. Its axis is the stem, and the first lateral outgrowths from the stem are the leaves. The vegetative shoot performs the nutrition of the plant. Reproduction also is a function of the shoot.

The typical stem is the organ which holds up, by its own strength, the leaves, where they will be properly illuminated, conducts water to them from the roots, and conducts the prepared food from leaves to parts where it is needed.

Branches are lateral outgrowths originating in the axils of the leaves. They also are composed of stem and leaves.

The places on the stem where leaves and branches originate are nodes. The intervals between them are internodes.

Growth of stem.

Rapidity. Distribution by night and day.

Distribution by "zones" marked on the stem. Length of growing region.

(A vine, some dicot. herb, and some grass should be used for these experiments.)

Direction.

Influence of gravity.

Influence of light.

Nutations.

Difference between main stems and branches.

Structure of stems.

The growing point. Embryonic tissues; dermatogen, periblem, plerome.

The epidermal tissue system; studied to better purpose in leaves.

The fundamental system.

Cortical parenchyma: A thin-walled tissue, serving for assimilation or storage, and, by the turgor of its cells, having some mechanical value.

Collenchyma: A mechanical tissue, the walls thickened at the corners of the cells, growth still possible.

Sclerenchyma: Strands of elongate cells, dead, with thick walls. Position of these strands.

The fibro-vascular system.

Stem of *Cyperus*.

Arrangement of bundles; their course.

The individual bundle.

Bundle sheath.

Xylem.

Annular vessels.

Spiral vessels.

Pitted tracheæ.

Phloem.

Sieve tubes.

Companion cells.

Stem of *Ricinus* (or other dicot).

Arrangement of bundles. The pith.

The individual bundle.

Xylem.

Phloem.

Cambium; fascicular and interfascicular.

Secondary thickening. Cells having the power to divide constitute a meristem. A secondary meristem is one whose cells have at some time been without the power to divide; interfascicular cambium is a secondary meristem. Secondary thickening involves the activity of secondary meristem.

Products of secondary thickening.

Cork. Phellogen. Lenticels.

"Bark."

Functions of stems.

Providing stiffness and strength.

Stiffness due to turgor.

Stiffness due to thick walls; arrangement of mechanical elements.

Conduction of food: Function of phloem; how demonstrated.

Conduction of water: Function of tracheæ. Demonstration with red ink.

In what layers of large trees.

Rapidity of movement.

Movement through dead stems.

Reduced stems: *Balanophora*, *Rafflesia*, *Taeniophyllum*.

Metamorphosed stems.

Twining plants: *Phaseolus*, *Ipomoea*.

Tendrils: *Cucurbita*.

Hooks: *Uncaria*, *Artabotrys*.

Spines: *Gmelina*, *Gleditschia*, *Citrus*.

Food stores: *Solanum*, *Caladium*, *Corypha*, *Zingiber*.

Water stores: *Opuntia*, *Euphorbia*, *Hydnophytum*.

Assimilating organ: *Asparagus*, *Equisetum*, *Muehlenbeckia*.

Reproductive organ.

Runners: Rhizomes.

Proliferous tips.

Bulbils.

THE LEAF.

Origin. Lateral outgrowths on the growing point.

Parts of leaf: Base, stalk or petiole, blade.

Growth. Limited, with few exceptions.

The axes of growth are the veins. By subsequent growth between them the lamina develops. The shape and margin of the leaf depend on the relative growth along different lines, and the extent to which the growth of the lamina falls behind that of the veins.

Rapidity of growth.

Influence of illumination.

Direction of growth.

Change with age.

Influence of gravity.

Influence of light.

Structure of leaf.

Epidermal tissue system.

Epidermal cells. Thickness of walls. Cuticle. Contents.

Trichomes. Hairs and scales; contents; functions. Glands.

Stomata. Guard cells; contents; ridges. Subsidiary cells.

Function. Distribution. Position, raised, superficial, or immersed.

Mechanism of movements. Influence of light; of moisture.

Fundamental system.

Palisade parenchyma.

Spongy parenchyma.

Water tissues; when present.

Sclerenchyma; when present.

Fibro-vascular system. Connection with stem.

Functions of leaves.

Photosynthesis. Formation of starch and sugar. The source of the raw materials.

Dependence on light.

Transpiration. Amount of water. Action of stomata.

Terms used in describing leaves.

Arrangement: Opposite, verticillate, decussate, alternate.

Form: Round, ovate, obovate, oval, oblong, lanceolate, oblanceolate, spatulate, linear, acicular.

Base: Peltate, reniform, cordate, sagittate, cuneate, attenuate.

Apex: Retuse, rounded, obtuse, acute, acuminate, caudate, mucronate.

Margin: Entire, sinuate, crenate, dentate, serrate; lobed, incised, parted, divided.

Surface: Glabrous, glaucous, pubescent, scabrous, hirsute, ciliate.

Texture: Coriaceous, herbaceous, fleshy, membranaceous.

Venation: Free, parallel, reticulate; pinnate, palmate.

Vernation.

Compound leaves: Ternate, palmate, pinnate, bipinnate, etc.

Adaptation of leaves.

Individual leaves or plants.

Immersion of water plants.

Shading and the size of leaves.

Shading and the margin, surface and texture.

Exposure to wind.

Insolation and red color.

Species of plants.

Leathery texture and shining upper surface: mangroves.

Caudate tips: Many species of Ficus.

Serrate margins, preventing passage of water to nether surface.

Submarginal veins.

Folding leaves: Cocos; Pithecolobium, Mimosa.

Hirsute leaves of Alpine plants; of young leaves.

Vertical position: Eucalyptus, Rhizophora.

Reduced blades or whole leaves.

Parasites: Cassytha; some orchids.

Photosynthesis performed by other members.

Metamorphosed blades or whole leaves.

Tendrils.

Formed by whole leaf, or by apex: Pisum, Flagellaria.

Spines.

Whole leaf: Cacti. Marginal: Acanthus, Ananassa, Cirsium, Agave.

Water storage: Agave, Kalanchoe, Niphobolus.

Protection to buds.

Protection to roots: Dischidia.

Humus gatherers: Asplenium, Drynaria, Thayeria.

Animal traps: Sarracenia, Darlingtonia, Nepenthes, Utricularia, Pinguicula,

Drosera, Dionæa.

Metamorphosed petioles.

Blade, for photosynthesis: *Acacia*, *Nepenthes*.

Tendrils: *Nepenthes*, *Tropæolum*.

Floats: *Eichhornia*, *Monochoria*.

Metamorphosed leaf bases.

Assimilating organ, stipules, replacing blade in *Lathyrus Aphaca*.

Sheath: Nearly all Monocots, *Polygonum*.

Tendril: *Smilax*.

Spines: *Acacia farnesiana*.

Hinge or pulvinus: *Mimosa*, *Pithecolobium*.

Food store: *Allium*.

False trunk: *Musa*.

Water reservoir: *Ravenala*.

Protection to buds: *Nauclea* (bancal), *Ficus elastica*, rain tree.

REPRODUCTION.

Sexual reproduction is a process in which two cells unite to form one, from which the offspring grows. These two sexual cells are called gametes.

If the gametes are alike, their uniting is called conjugation, and the resulting cell is a zygospore.

If the gametes are unlike their uniting is called fertilization. The smaller, more active gamete is the spermatozoid; the larger, usually passive gamete is the ovum. The product of fertilization is an egg.

Reproduction which is not sexual is asexual, but this term is usually restricted to spore reproduction.

A spore is a specialized reproductive cell, capable by itself (i. e., without fusing with another cell) of giving rise to a plant. Some spores are composed of several cells, but one of these can grow into a plant. According to their origin or structure, spores have various names.

Reproduction accomplished without highly specialized single cells is vegetative. The simplest form of reproduction is the fission of single cells.

Because of their minuteness, very rich contents, and absence of walls gametes are decidedly the most vulnerable point in a plant's life history. They are therefore most constantly removed from contact with the environment.

The environment is very likely responsible for the variations of plants, and is certainly responsible for the perpetuation of these variations, as characters. The differences between nearly related plants are therefore in the characters on which the environment acts most readily and constantly, while a structure well shielded from exposure to the environment will be constant in all nearly related plants, and will characterize large groups.

Therefore the reproductive structures usually furnished the best basis for the characterization of large groups of plants.

CLASSIFICATION OF PLANTS.

The most primitive organisms are probably those bacteria which are not parasitic or saprophytic. They existed before either plants or animals. One of these is common in the Philippines, in iron springs. From these are descended the other bacteria, and the Schizophyceæ, such as *Oscillatoria* and *Anabæna*.

The great groups of plants are:

Thallophytes: Plants typically without differentiated leaf, stem, and root, and without the tissues and specialized reproductive structures of higher plants.

Algæ: With chlorophyll.

Fungi: Without chlorophyll.

Archegoniates: Plants with evident alternation of generations, and whose female reproductive organ is an archegonium.

Bryophytes: The sexual generation is "the plant": Mosses and liverworts.

Pteridophytes: The asexual generation is "the plant": Ferns and club mosses.

Spermatophytes: The offspring disseminated in the form of seed: Flowering plants.

Gymnosperms: Seeds not borne in a closed ovary: Agathis, Pinus, Podocarpus.

Angiosperms: Seeds formed inside a closed ovary: All common flowering plants.

Monocotyledones: Seeds with one cotyledon, fibro-vascular bundles scattered in stem; no secondary thickening.

Dicotyledones: Seeds with two cotyledons, fibro-vascular bundles of stem in a ring, with secondary thickening.

ALGÆ.

[Plants with asterisk (*) should be studied in the laboratory.]

Chlorophyceæ: Algæ whose color is the green of chlorophyll.

Chlamydomonas; unicellular and always motile.

"Protococcus" or Palmella; * unicellular, or cells sometimes forming small clusters, but independent; motile only in reproductive stages.

Ulothrix; * a filament of independent cells.

Reproduction by zoospores—motile asexual cells—and by conjugation.

Ulothrix passes through Palmella and Protococcus stages.

Spirogyra; * gametes look alike but behave differently.

The living nucleus and the movement of protoplasm should be seen in Spirogyra.

Oedogonium. * A filament with an anchored basal cell. Reproduction by zoospores and by oospores. Monœcious, diœcious, or with dwarf males.

Vaucheria. Reproductive organs, antheridia and oogonia; gametes, antherozoids and ova. Thallus consists of a single cell, with many nuclei. A rudimentary root often present; and in related plants, rudimentary stem and leaves.

Phæophyceæ. Sphacelaria; Padina; Sargassum.

Rhodophyceæ.

Characeæ.

FUNGI.

Zygomycetes; sexual reproduction by conjugation.

Mucor; * asexual reproduction by spores in sporangia.

Syncephalis; * spores are conidia.

Oomycetes; sexual reproduction by fertilization.

Peronospora.

Ascomycetes; spores borne in sacs, called asci: probably the largest group of plants.

Saccharomyces. *

"Peziza." *

Basidiomycetes; spores borne on basidia.

Uredinæ; the rusts. Æcidia, teleutospores, and uredospores.

Hemileia, * the coffee rust.

Hymenomycetes; hymenium exposed to the air.

Polyporus.* Hymenium lining tubes. Enemies of timber.

Agaricus.* Hymenium spread over gills. Edible and poisonous mushrooms.

Gasteromycetes; hymenium inclosed.

Lycoperdon * or Bovista. Puffballs. Edible.

Dictyophora. Dissemination of spores.

Lichenes.

BRYOPHYTA.

Hepaticæ, the liverworts.

Riccia;* Cyathodium; Marchantia.

Anthoceros.*

Musci, the mosses.

Funaria.

PTERIDOPHYTA.

Filicineæ; leaves usually large and few.

* The life history of one fern should be gone through in detail in the laboratory.

The students should learn here to determine plants by means of keys.

The instruction (not necessarily the laboratory work) should cover a series beginning with forms with hermaphrodite prothallia and no differentiated sporophylls, through forms with unisexual prothallia and distinct sporophylls (as Polybotrya), to Marsilea,* with very different spores.

Lycopodiineæ; leaves small and numerous.

Lycopodium, homosporous.

Selaginella;* heterosporous; the sporophylls aggregated at the apex, the flower.

Equisetineæ; leaves reduced to scales and replaced by stem.

SPERMATOPHYTA.

A flower is a reproductive structure, composed of one or more aggregated sporophylls, usually with specialized accessory leaves, and the stem apex which bears them.

The macrosporophylls of flowering plants are called carpels. The carpels of a flower constitute its *gynæcium*. A pistil is composed of one or more carpels fused together.

The parts of a pistil are:

The stigma, a terminal part, often enlarged, with a felty surface adapted to the reception of pollen.

The style, a stalk, bearing the stigma; it is often wanting, and the stigma is then sessile.

The ovary, a closed sac formed by the lower parts of the carpels. Each cavity in the ovary is called a *loculus*, or cell. The lines along which the macrosporangia are borne are *placentæ*; these are usually the margins of the carpels.

The microsporophylls of flowering plants are called stamens. The stamens of a flower constitute its *androcium*.

The parts of a stamen are:

The filament, or stalk. When all the filaments are grown together, they are *monadelphous*.

The anther, the large upper part, containing the microsporangia, or pollen sacs. When the anthers are grown together they are *syngenesious*.

A flower containing both kinds of sporophylls is perfect. If it contains only one kind it is diclinous, and either staminate or pistillate. If both kinds of diclinous flowers are on the same individual, the plant it is monœcious; if on different individuals, it is diœcious.

The accessory leaves forming part of a flower constitute the perianth. If two kinds of such leaves are present the outer ones are called sepals and the inner ones petals. As a general rule the function of the sepals is protective, while the petals usually serve to insure pollination.

The sepals of a flower constitute its calyx.

When the calyx and the ovary are grown together, the ovary is said to be inferior and the calyx superior; when they are not grown together the ovary is superior and the calyx inferior.

The petals of a flower constitute the corolla.

If but one kind of perianth leaves are present, they are called sepals and the flower is apetalous. If the petals are grown together, even at the base, the flower is sympetalous. If they are separate, it is choripetalous.

If the petals are borne on the axis of the flower below the ovary, they are hypogynous; if they are attached to part of the height of the ovary, perigynous; if grown fast to its whole height, epigynous. The stamens are epipetalous if their filaments are partly or wholly adnate to the corolla.

A flower whose leaves of each kind are all alike is actinomorphic, or regular; if the leaves of one or more kinds differ among themselves, it is zygomorphic, or irregular.

The macrosporangia of flowering plants are called ovules. Each contains one macrospore (except in *Casuarina*), called an embryo sac.

The ovule is attached to the placenta by a stalk, the funiculus. It has two coats, through which there is an apical opening, the micropyle. Within the coats is a tissue called the nucellus, in which is the embryo sac. The region where the funiculus, coats, and nucellus are in contact is the chalaza.

If the funiculus, chalaza, embryo sac, and micropyle are in a straight line, the ovule is orthotropous. If the chalaza, embryo sac, and micropyle are in a straight line, but the funiculus is grown fast along the ovule, bringing the micropyle near the funiculus, the ovule is anatropous. If the ovule itself is bent, so that the chalaza, embryo sac, and micropyle are not in a straight line, it is campylotropous.

The microsporangia are the pollen sacs and the microspores the pollen grains.

The pollen grain germinates on the stigma, emitting a pollen tube, which grows through the style to the ovary, and enters the ovule, usually through the micropyle. It contains two generative nuclei, of which one fuses with the nucleus of the ovum, or female gamete. The resultant growth is the embryo.

The seed is a reproductive structure, adapted to dissemination, developed from the ovule as a result of fertilization. It consists of the seed coats, the embryo, and often of an endosperm.

The fruit is a structure containing one or more seeds, developed from the ovary or from the ovary and some accessory members, as the result of pollination.

The accessory members frequently involved are the calyx and the receptacle.

Classification of fruits.

Dry.

Indehiscent.

Fruit coats thick and hard.....	Nut	<i>Cocos</i>
Fruit coats thin.		
Fruit coats adnate to seed	Caryopsis	<i>Rice, Maize</i>
Fruit coats and seed separate	Achenium	<i>Compositæ</i>

Dehiscent.

Fruit of one carpel.

Opening along ventral suture	Follicle	<i>Connarus</i>
Opening along both sutures.		
Constricted between seeds	Loment	} <i>Leguminosæ</i>
Not constricted	Legume	

Fruit of two or more carpels.

Opening by longitudinal cracks	Capsule	<i>Nicotiana</i>
Opening by a lid	Pyxidium	<i>Portulaca</i>

Fleshy.

Containing a "stone"	Drupe	<i>Mangifera</i>
Seed without stony case	Berry	<i>Carica</i>

Beside these simple fruits, there are compound or aggregate fruits, such as those of the strawberry and fig, each of which is composed of a fleshy receptacle, bearing many minute achenia.

Flowers are solitary (borne on scapes), or arranged in inflorescences.

Inflorescences are—

Indeterminate, the superior flowers blossoming last.

The main axis elongated.

Axis unbranched.

Flowers stalked	Raceme	<i>Antigonon</i>
Flowers sessile.		

 Axis not fleshy

 Spike *Verbena*

 Axis fleshy

 Spadix *Araceæ*

Axis branched

 Panicle *Palmaceæ*

Main axis very short.

 Flowers stalked

 Umbel *Umbelliferæ*

 Flowers sessile

 Head *Compositæ*

Determinate, terminal flower blossoming first

 Cyme *Premna*

GYMNOSPERMÆ.

Cycas.* Macrosporophylls and microsporophylls very unlike.

The macrospore never leaves the parent plant, dissemination being in an arrested state of the young sporophyte. Archegonium and spermatozoids still formed.

Coniferæ: Pinus, Agathis, Podocarpus.

Gnetum.

ANGIOSPERMÆ.

MONOCOTYLEDONES.

Liliifloræ.

Liliaceæ. Allium, Lilium, Dracæna, Asparagus.

Dioscoreaceæ. Dioscorea.

Bromeliaceæ. Ananassa.

Glumifera: The grasses and sedges.

Gramineæ. Saccharum, Zea, Oryza,* Triticum, Bambusa.

Spadicifloræ.

Araceæ. Arum, Colocasia.

Principes.

Palmaceæ. Cocos,* Areca, Arenga, Nipa, Calamus.

Pandanaceæ.

Scitamineæ.

Musaceæ. Musa.*

Zingiberaceæ.

Gynandrea.

Orchidaceæ.

DICOTYLEDONES.

Apetalæ.

Piperales.

Piperacæ. Piper.*

Urticales.

Moracæ. Artocarpus, Ficus.

Choripetalæ.

Centrospermæ. Beta.

Ranales.

Anonacæ. Anona,* Canangium.

Rhcæadales.

Cruciferæ. Raphanus,* Brassica.

Rosales.

Leguminosæ. Phaseolus, Arachis, Vicia, Pithecolobium, Pisum, Sesbania,* Mimosa, Tamarindus, Pterocarpus, Erythrina, Poinciana, Intsia, Pahunia.

Geraniales.

Rutacæ. Citrus, Murraya.

Meliacæ. Sandoricum, Lansium.

Combretacæ. Terminalia.

Euphorbiacæ. Manihot, Ricinus.

Anacardiaceæ. Mangifera, Anacardium.

Malvales.

Tiliacæ. Muntingia.

Malvacæ. Hibiscus.*

Parietales.

Theacæ. Thea.

Guttiferæ. Garcinia, Calophyllum.

Dipterocarpaceæ.

Caricacæ. Carica.*

Myrtifloræ.

Rhizophoracæ.

Myrtacæ. Psidium, Eugenia.

Umbelliferæ. Apium, Daucus.

Sympetalæ.

Ebenales.

Sapotacæ. Achras, Mimosa, Palaquium.

Ebenacæ. Diospyros.

Tubifloræ.

Convolvulacæ. Ipomœa.*

Verbenacæ. Vitex.

Solanacæ. Solanum, Lycopersicum, Capsicum, Nicotiana.

Rubiales.

Rubiaceæ. Coffea,* Ixora.

Campanulatæ.

Cucurbitacæ. Cucurbita, Luffa, Momordica, Cucumis.

Compositæ. Vernonia,* Lactuca.

DISSEMINATION OF SEED.

By violent discharge. Bauhinia, Ricinus, Oxalis.

By awns, driving fruit when moved. Many grasses.

By floating. Cocos and many other strand plants.

By wind.

Whole plant rolls. "Tumble-weeds."

Inflorescence rolls. *Spinifex*.

Inflorescence flies. *Tilia*.

Fruit flies.

By wing. *Dipterocarpus*, *Pterocarpus*, *Ailanthus*.

By parachute. *Compositæ*.

Seed flies.

By wing. *Dioscorea*, *Pterospermum*, *Zanonia*.

By parachute or hairs. *Asclepiadaceæ*, *Ceiba*.

By minuteness. *Orchidaceæ*.

By animals.

By being eaten.

Devices to attract animals.

Devices to prevent digestion of seed.

By adhering to animals. *Burs*.

POLLINATION.

Self-pollination.

Cleistogamous flowers.

Cross-pollination. Necessary when flowers are *diclinous*, or when stamens and pistils mature at different times. Presumably advantageous in other cases.

Pollen carried by water.

Pollen carried by wind. *Anemophily*.

Character of pollen. Amount produced.

Character of stigma.

Special adaptations. Pollen only freed when air is dry. Versatile anthers. Pendent inflorescences. Position of flowers on plant. Forcible discharge of pollen.

Pollen carried by insects. *Entomophily*.

Devices to attract animals.

Odor. *Cestrum*, *Canangium*, *Jasminum*, *Rafflesia*.

Color. *Ixora*, *Jasminum*, *Rafflesia*.

Size of "advertisement." Use of sepal (*Mussaenda*) or bracts (*Euphorbia*). Flowers specialized for show alone. *Compositæ*.

Advantage to insect.

Shelter.

Food. Nectar, honey; sometimes pollen.

Place to lay eggs. *Ficus*.

Special adaptations.

Tubular flowers.

Zygomorphic flowers.

Styles and filaments of different length.

Flowers open at particular hours.

Imprisonment of insects. *Araceæ*, *Aristolochia*.

Sticky pollen-masses. *Orchidaceæ*, *Asclepiadaceæ*.

Pollen carried by birds. *Ornithophily*.

NATURAL SELECTION.

No two plants exactly alike. No plant exactly like its parents. Variation universal. Variation in all directions.

Because plants are adapted to their environment, any variation considerable enough to affect its welfare is nearly always detrimental.

Limits of variation fixed by heredity, the conservative factor in variation and evolution.

Causes of variation.

Amphimixis. Mingling of inherited characters.

Environment. Direct action certainly very limited.

Over-production.

More seeds mature and germinate every year that can possibly grow to mature plants and have offspring.

Therefore, there is an unceasing struggle for existence.

Survival of the fittest.

In the struggle for existence, the plants having any advantage, even the slightest, over their competitors, will be the most likely to mature and bear offspring. An advantageous variation will thus be perpetuated; while a disadvantageous one will interfere with a plant's surviving, and is thus unlikely to be perpetuated. So variation, in spite of being dangerous to the individual plants, makes possible an improvement of the race.

Improvement in any race is merely better adaption to the conditions under which it lives.

PLANT BREEDING.

Stimulation of variation by hybridization.

Selection of plants with desirable variations, and propagation from them.

Artificial selection differs from natural selection only in the presence of a new factor, the will of man.

PLANTS AND THEIR ENVIRONMENT.

Of the factors in the environment, the most important in determining the structures and modifications of plants and their local distribution is water. With regard to their need for water, plants may be classified as xerophytes, tropophytes, mesophytes, and hydrophytes; these classes are not sharply distinguishable.

A xerophyte is a plant able to endure a very dry environment without injury.

Xerophytes are usually found in deserts, in very windy places, in salty, in cold or arid ground, or as epiphytes.

Some plants are xerophytes in that they can endure the loss of water without injury: Mosses, lichens, Hymenophyllaceæ.

Most xerophytes are able to endure dryness because they do not readily become dry. Many of them have stores of water, and all of them have such structures as will restrict the loss of water. Such are:

Absence of leaves: Cacti, Euphorbia, Tæniophyllum.

Thick leaves, with limited surface: Agave, Ananassa, Pinus.

Leaves on edge: Eucalyptus, Ceriops.

Leaves folding or rolling: Mimosa, Antrophyum.

Thick, waxy epidermis: Hoya, Cycas.

Protective trichomes: Gnaphalium, Ærua.

Small, or few, or immersed stomata: Cyclophorus.

A tropophyte is a plant adapted to a periodically very drying environment.

Deciduous plants are tropophytic.

A mesophyte is a plant able to endure moderate but never extreme dryness.

Hydrophytes are plants whose environment must always be very wet. Their modifications are such as will permit the free entrance, circulation, and exit of gases. Such are:

Very copious intercellular spaces: Monochoria, Ceratopteris, Pistia.

Thin, glabrous epidermis: Limnanthemum, Hydrilla, Potamogeton.

Numerous superficial stomata: Nelumbium.

Finely dissected leaves: Ceratophyllum, Naias, Utricularia.

PLANT SOCIETIES.

All the plants, of various kinds, growing in any kind of a place, constitute a plant society. The principal plants societies in the Philippines, most of which can in turn be divided into many minor societies, are:

Aquatics, in salt water: Mostly Algæ.

Aquatics, in fresh water: Pistia, Vallisneria, Algæ.

Strand: Cocos, Ipomœa Pes-Capræ.

Salt marsh: Acanthus, Achrostichum, Scyphiphora.

Fresh marsh: Monochoria, Cyperaceæ.

Meadow: Succulent grasses, Vandellia.

Cogonal: Cogon, Antidesma.

Parang: Thickets, Psidium, Lygodium.

Mountain pasture: Dry grasses, Pinus.

High forest: Dipterocarpus, Calamus.

Rain forest: Quercus, Agathis, tree ferns.

Mossy forest: Leptospermum, mosses, ferns, lichens.

Montane brush: Vaccinium and Rhodendron, on Apo and Halcon.

PLANT GEOGRAPHY.

The ancestors of all Philippine plants migrated to these Islands from without. The flora of the southern islands is entirely Malayan, that of Paragua and the Jolo Archipelago being like that of Borneo, while Mindanao contains more plants from Celebes or beyond it. A northern element is more evident in Luzon and is dominant on the drier mountains.

II. KEY TO THE FAMILIES OF VASCULAR PLANTS IN THE PHILIPPINE ISLANDS.

No seeds formed, the development of the sporophyte being un- interrupted	PTERIDOPHYTA
Seeds formed	SPERMATOPHYTA
Ovules not inclosed in an ovary	GYMNOSPERMÆ
Carpels forming a closed ovary	ANGIOSPERMÆ
Cotyledon single, vascular bundles scattered	MONOCOTYLEDONES
Cotyledons two, bundles usually in a ring.....	DICOTYLEDONES

PTERIDOPHYTA.

1. Leaves large in proportion to stem (*Filicineæ*)
 2. Sporangia developed from a group of cells, often 1 mm
in diameter.
 3. Sporangia dorsal, in groups, on very large fronds.. (1) Marattiaceæ
 3. Sporangia marginal, on reduced fronds, solitary.... (2) Ophioglossaceæ
 2. Sporangia developed from single epidermal cells.
 3. Homosporous, mostly terrestrial, sporangia minute.
 4. Leaves thin, without differentiated mesophyll
or stomata (3) Hymenophyllaceæ
 4. Leaves with the usual tissues of flowering
plants.
 5. Tree ferns; annulus oblique, complete.. (4) Cyatheaceæ
 5. Seldom tree ferns, and then with in-
terrupted annulus.
 6. Annulus longitudinal, interrupted
by stalk of sporangium (5) Polypodiaceæ
 6. Annulus oblique; an aquatic
plant (6) Parkeriaceæ
 6. Annulus transverse.
 7. Annulus medial; sporangia
in sori (7) Gleicheniaceæ
 7. Annulus subapical; sporan-
gia solitary (8) Schizæaceæ
 6. Annulus rudimentary; stomium
vertical (9) Osmundaceæ
 3. Heterosporous; plants growing in mud or water.
 4. Sterile leaves quadripartite, cruciform..... (10) Marsileaceæ
 4. Leaves simple; plant floating (11) Salviniaceæ
 1. Leaves small, numerous, on elongate stems (*Lycopodineæ*)
 2. Homosporous.
 3. Sporangia unilocular (12) Lycopodiaceæ
 3. Sporangia 2- or 3-locular..... (13) Psilotaceæ
 2. Heterosporous..... (14) Selaginellaceæ
 1. Leaves reduced to whorled teeth; stems hollow (15) Equisetaceæ

SPERMATOPHYTA.

GYMNOSPERMÆ.

1. Leaves very large, pinnate (16) Cycadaceæ
1. Leaves small, simple.
 2. Perianth none; resin ducts in mesophyll (*Coniferæ*)
 3. Pistillate flower of few carpels; seeds visible (17) Taxaceæ
 3. Carpels numerous, concealing the seeds (18) Pinaceæ
 2. Perianth present, inconspicuous; resin ducts none (19) Gnetaceæ

ANGIOSPERMÆ.

MONOCOTYLEDONES.

1. Flowers protected by chaffy bracts, perianth wanting or nearly so (*Glumifloræ*)
 2. Glumes more than one; leaf sheath slit..... (28) Graminæ
 2. Glume one; sheath not slit..... (29) Cyperaceæ
1. Flowers without glumes; borne on a spadix, protected by a spathe (*Spadicifloræ*)
 2. Minute floating aquatic plants..... (32) Lemnaceæ
 2. Terrestrial or marsh plants, not minute..... (31) Araceæ
1. Flowers glumeless, not on a spadix, with or without a perianth.
 2. Trees or woody vines, without perianth..... (21) Pandanaceæ
 2. Herbaceous, or with a perianth.
 3. Aquatic or marsh plants; perianth wanting or inconspicuous.
 4. Leafy stem erect in air, with terminal spike..... (20) Typhaceæ
 4. Marsh plants, without erect leafy stem (25) Alismataceæ
 4. Immersed plants.
 5. Ovary superior.
 6. Flowers perfect.
 7. Without corolla-like perianth..... (22) Potamogetonaceæ
 7. Perianth corolla-like Aponogetonaceæ
 6. Flowers declinuous (23) Naiadaceæ
 5. Ovary inferior (26) Hydrocharitaceæ
 3. Terrestrial plants, or perianth evident.
 4. Woody plants, with very broad or compound leaves (30) Palmæ
 4. Herbs, or leaves narrow.
 5. Flowers regular or nearly so; endosperm mealy.
 6. Ovary superior; herbs without green leaves (27) Triuridaceæ
 6. Ovary superior; leaves green.
 7. Vine, climbing by leaf tips..... (33) Flagellariaceæ
 7. Not scandent vines.
 8. Ovary 1-celled (34) Xyridaceæ
 8. Ovary 2- or 3-celled.
 9. Flowers declinuous (35) Eriocaulaceæ
 9. Flowers perfect.
 10. Perianth none (33a) Centrolepidaceæ
 10. Calyx and corolla differentiated (37) Commelinaceæ
 10. Perianth all corolla like.
 11. Perianth leaves alike, united..... (38) Pontederiaceæ
 11. Outer cycle larger, partly united Philodracæ
 6. Ovary inferior (36) Bromeliaceæ
 5. Flowers regular or nearly so; endosperm fleshy or bony.
 6. Ovary superior.
 7. Seed starchy; perianth bracteose.. (39) Juncaceæ
 7. Seed not starchy.
 8. Vines without tendrils..... (40) Stemonaceæ
 8. Not vines, or with tendrils.... (41) Liliaceæ
 6. Ovary inferior, or partly so.
 7. Vines, scandent or prostrate..... (40) Dioscoreaceæ
 7. Not vines.
 8. Anthers half-introrse (41) Liliaceæ
 8. Anthers introrse.
 9. Ovary with more than one cell (42) Amaryllidaceæ

- 9. Ovary 1-celled (43) Taccaceæ
- 8. Anthers extrorse (45) Iridaceæ
- 5. Flowers decidedly irregular.
- 6. Fruit a berry, or seed not minute.
- 7. Fertile stamens 5 (46) Musaceæ
- 7. Fertile stamen 1.
- 8. Lamina of leaf not jointed to petiole.
- 9. Style slender (47) Zingiberaceæ
- 9. Style stout (48) Cannaceæ
- 8. Lamina articulate to petiole.. (49) Marantaceæ
- 6. Fruit a capsule with minute seeds.
- 7. Stamens 6; endosperm present..... (50) Burmanniaceæ
- 7. Fertile stamens fewer; no endosperm (51) Orchidaceæ

DICOTYLEDONES.

- Perianth absent, or calyx and corolla not distinct..... APETALÆ
- Corolla present, petals distinct and separate POLYPETALÆ
- Corolla present, petals more or less united..... SYMPETALÆ

Apetalæ.

- 1. Trees with jointed stems and very reduced leaves (52) Casuarinaceæ
- 1. Not trees with jointed stems.
- 2. Juice milky.
- 3. Ovary 1-celled (61) Moraceæ
- 3. Cells of ovary more than 1 (mostly 3)..... (114) Euphorbiaceæ
- 2. Without latex; staminate flowers in aments, polypetalous, pistillate flowers apetalous..... (148) Datisceæ
- 2. Without latex; staminate flowers apetalous, in aments.
- 3. Leaves simple.
- 4. Fruit a drupe..... (55) Chloranthaceæ
- 4. Fruit not a drupe.
- 5. Inflorescence simple.
- 6. Herbs, vines or broad-leaved shrubs.
- 7. Carpels one or united..... (54) Piperaceæ
- 7. Carpels nearly distinct..... (53) Saururaceæ
- 6. Shrubs with lanceolate, thin leaves (56) Salicaceæ
- 6. Trees with hard leaves..... (59) Fagaceæ
- 5. Inflorescence compound (57) Myricaceæ
- 5. Inflorescence compound (58) Juglandaceæ
- 3. Leaves pinnate (93) Nepenthaceæ
- 2. Without latex; flowers not in aments, hypogynous.
- 3. Leaves metamorphosed as insect traps..... (92) Moringaceæ
- 3. Leaves not insectivorous; woody plants.
- 4. Leaves pinnately decompound..... (92) Moringaceæ
- 4. Leaves not decompound.
- 5. Ovary 1-celled, ovule 1.
- 6. Stipules present.
- 7. Stigmas 2 (60) Ulmaceæ
- 7. Stigma 1 (62) Urticaceæ
- 6. Stipules wanting.
- 7. Suffrutescent, with dense white inflorescence (73) Amarantaceæ
(*Ærua*)
- 7. Vines; leaf base acute..... (66) Opiliaceæ
(*Opilia*)
- 7. Vines; leaf base broad..... (82) Menispermaceæ
(*Anamirta*)
- 7. Trees or shrubs.
- 8. Not diœcious; sepals free.
- 9. Pedicel enlarged in fruit (65) Santalaceæ
(*Exocarpus*)

9. Pedicel not enlarged (66) Opiliaceæ
(*Champereia*)
8. Dioecious; sepals united (85) Myristicaceæ
5. Ovary 1-celled, ovules 2.
6. Flowers perfect, large..... (63) Proteaceæ
6. Flowers diclinous, small..... (114) Euphorbiaceæ
(*Phyllanthus*)
5. Ovary 1-celled, ovules more than 2.
6. Placenta basal (73) Amarantaceæ
(*Deeringia*)
6. Placentæ parietal (145) Flacourtiaceæ
5. Carpels 3 to 5, distinct or nearly so.
6. Stamens forming a tube..... (136) Sterculiaceæ
6. Stamens free (86) Monimiaceæ
5. Ovary 1, with 2 or more cells.
6. Leaves pinnate (126) Sapindaceæ
6. Leaves not pinnate; ovules 1 or 2; styles seldom united.
7. Fruit broadly winged..... (126) Sapindaceæ
(*Dodonæa*)
7. Fruit without broad wing.
8. Raphe ventral (toward axis of fruit) .. (114) Euphorbiaceæ
8. Raphe dorsal; fruit a dehiscent capsule .. (116) Buxaceæ
6. Leaves not pinnate; ovules 4 or more; style 1.
7. Flowers perfect (91) Capparidaceæ
(*Stiris*)
7. Flowers diclinous (136) Sterculiaceæ
(*Sterculia*)
3. Leaves not insectivorous; herbs.
4. Terrestrial parasites; leaves reduced (68) Balanophoraceæ
4. Very small aquatics (115) Callitrichaceæ
4. Not parasites nor minute aquatics.
5. Ovary 1, ovule 1, perianth not corolline.
6. Aquatic with whorled linear leaves (79a) Ceratophyllaceæ
6. Not aquatics with whorled linear leaves.
7. Stipules present (62) Urticaceæ
7. Leaves none or with sheathing base (except *Antigonon*) (71) Polygonaceæ
7. Leaves without stipules or sheaths.
8. Flowers without bracts..... (72) Chenopodiaceæ
8. Flowers with bracts... (73) Amarantaceæ
5. Ovary 1, ovule 1, calyx corolla-like... (74) Nyctaginaceæ
5. Ovary 1-celled, ovules many (73) Amarantaceæ
5. Ovary incompletely septate, ovules many (153) Lythraceæ
5. Ovary 3-celled, 1 ovule in each..... (114) Euphorbiaceæ
5. Ovary completely septate, ovules many.. (75) Alzooceæ
5. Carpels several, distinct, 1-seeded..... (80) Ranunculaceæ
5. Carpels distinct or nearly so, ovules many (96) Saxifragaceæ
(*Astilbe*)
2. Without latex; flowers not in aments, ovary in part or wholly inferior.
3. Parasites with enormous flowers..... (70) Rafflesiaceæ
3. Parasites with small flowers.
4. Thread-like vines, not green (87) Lauraceæ
(*Cassytha*)

4. Partial parasites, with green leaves.
 5. Placenta and ovule indistinguishable.. (64) Loranthaceæ
 5. Ovule on an evident axial placenta.... (65) Santalaceæ
3. Not parasites; woody plants.
 4. Ovary 1-celled; fruit with 1 seed.
 5. Leaves clothed beneath with stellate scales (152) Elæagnaceæ
 5. Leaves without stellate pubescence.
 6. Anthers opening by trap-doors.
 7. Stamens more than 1 cycle (8 or more)..... (87) Lauraceæ
 7. Stamens in 1 cycle (3 to 6).. (88) Hernandiaceæ
 6. Anthers opening by longitudinal slits:
 7. Ovary hairy (151) Thymelæaceæ (*Wikstræmia*)
 7. Ovary glabrous.
 8. Shrubs (151) Thymelæaceæ (*Daphne*)
 8. Vines or large trees.. (158) Combretaceæ
 4. Ovary 2-celled, 1 ovule in each..... (99) Hamamelidaceæ
 4. Ovary more or less septate, ovules many.
 5. Vines or shrubs (69) Aristolochiaceæ
 5. Trees..... (154) Sonneratiaceæ
 3. Not parasites; herbs..... (162) Halorrhagidaceæ (*Gunnera*)

Polypetalæ.

1. Aquatics, with large flowers and round floating leaves..... (75) Nymphæaceæ
1. Not large-flowered aquatics.
 2. Ovary free from the calyx.
 3. Stamens as many as petals, opposite them..... A
 3. Stamens 2, petals 4..... B
 3. Stamens alternate with petals, or more or less numerous, but not more than twice as many..... C
 3. Stamens more than twice as many as petals..... D
 2. Ovary partly or completely inferior..... E

A.

1. Carpel 1, with 1 ovule..... (77) Basellaceæ
1. Carpels more than 1, distinct and free (82) Menispermaceæ
1. Carpels more than 1, united.
 2. Stipules none, petals alternate with sepals.
 3. Ovary septate at the bottom..... (67) Olacaceæ (*Strombosia*)
 3. Ovary not at all septate..... (169) Myrsinaceæ (*Embelia*)
 2. Stipules none, petals opposite sepals (127) Sabiaceæ
 2. Stipules present, leaves simple.
 3. Ovule 1 in each cell; not typical vines (129) Rhamnaceæ
 3. Ovules 2 in each cell; vines (130) Vitaceæ
 2. Stipules present, leaves compound..... (130) Vitaceæ

B.

1. Herb (90) Cruciferae (*Lepidium*)
1. Woody plants (175) Oleaceæ

C.

1. Herbs.
 2. Carpel 1, fruit a legume (102) Leguminosæ
 2. Carpels 5, distinct (95) Crassulaceæ
 2. Carpels more than 1, ovary compound.
 3. Leaves radical and alternate, insectivorous (94) Droseraceæ
 3. Leaves not insectivorous, opposite, simple.
 4. Anthers free; stipules present.
 5. Styles free; ovary septate..... (142) Elatinaceæ

- 5. Styles partly united; ovary incom-
 - pletely septate (78) Caryophyllaceæ
- 4. Anthers free; stipules none (78) Caryophyllaceæ
- 4. Anthers syngenesious (128) Balsaminaceæ
- 3. Leaves not insectivorous, opposite, compound..... (106) Zygophyllaceæ
- 3. Leaves not insectivorous, alternate.
 - 4. Petals 4; stamens tetradynamous (90) Cruciferae
 - 4. Not tetradynamous; leaves compound.
 - 5. Carpels 2 (91) Capparidaceæ
(*Gynandropsis*)
 - 5. Carpels 3 (126) Sapindaceæ
(*Cardiospermum*)
 - 5. Carpels 5 (103) Oxalidaceæ
(*Oxalis*)
 - 4. Not tetradynamous; leaves simple.
 - 5. Leaves peltate (104) Tropæolaceæ
 - 5. Leaves not peltate.
 - 6. Flowers irregular.
 - 7. Stipules none (112) Polygalaceæ
 - 7. Stipules present (144) Violaceæ
(*Viola*)
 - 6. Flowers regular (136) Sterculiaceæ
- 1. Woody plants; fruit not a legume; leaves with more or less
 - evident pellucid dots (107) Rutaceæ
- 1. Woody plants; no pellucid dots, or fruit a legume.
 - 2. Leaves opposite, simple, carpels free (117) Coriariaceæ
 - 2. Leaves opposite, simple, carpels united.
 - 3. Carpels 2, ovule 1 in each cell..... (151) Thymelæaceæ
(*Phaleria*)
 - 3. Carpels 3, ovule 1 in each cell..... (111) Malpighiaceæ
 - 3. Carpels 3, ovules more numerous (121) Hippocrateaceæ
 - 3. Carpels 4 to 7.
 - 4. Leaves with a single midrib (120) Celastraceæ
 - 4. Leaves with several ribs (160) Melastomataceæ
- 2. Leaves opposite, compound.
 - 3. Carpel 1; anther opening by trap-doors..... (81) Berberidaceæ
 - 3. Carpels 2 or 3, stamens 8 to 10..... (98) Cunoniaceæ
 - 3. Carpels 3, stamens 5 (123) Staphyleaceæ
- 2. Leaves alternate, simple.
 - 3. Carpel 1.
 - 4. Fruit a capsule.
 - 5. Stamens; 5 fertile and 5 sterile.
 - 6. Capsule hairy (101) Connaraceæ
(*Ellipanthus*)
 - 6. Capsule glabrous.
 - 7. Vines or trees..... (102) Leguminosæ
(*Bauhinia* sp.)
 - 7. A small shrub..... (84) Anonaceæ
(*Anaxagorea* sp.)
 - 5. Fertile stamens 10 (102) Leguminosæ
 - 4. Fruit fleshy (118) Anacardiaceæ
 - 3. Carpels more than 1, distinct.
 - 4. Only 1 carpel fertile (118) Anacardiaceæ
(*Buchanania*)
 - 4. More than 1 carpel fertile (84) Anonaceæ
 - 3. Carpels plural, ovaries distinct, styles united.
 - 4. Filaments well developed (108) Simarubaceæ
(*Samadera*)
 - 4. Filaments shorter than anthers (138) Ochnaceæ
(*Ouratea*)
- 3. Carpels plural, ovary compound, 1-celled.
 - 4. Flower regular, ovary sessile.
 - 5. Style 1.
 - 6. Stipules wanting (97) Pittosporaceæ
 - 6. Stipules small (144) Violaceæ
 - 5. Styles 3 (118) Anacardiaceæ
(*Semecarpus*)

- 5. Stigmas sessile.
 - 6. Filaments not united (124) Icacinaceæ
 - 6. Filaments forming a tube..... (145) Flacourtiaceæ
(*Ryparosa*)
- 4. Flower regular, gynophore present.
 - 5. Erect plants with perfect flowers..... (97) Pittosporaceæ
 - 5. Dioecious or scandent (146) Passifloraceæ
- 4. Flower irregular.
 - 5. Two of the sepals petaloid..... (112) Polygalaceæ
(*Xanthophyllum*)
 - 5. Five sepals, all similar..... (144) Violaceæ
- 3. Ovary compound, with more than 1 cell.
 - 4. Filaments forming a closed tube, part or all of their height.
 - 5. Stigma single, stamens 10..... (110) Meliaceæ
 - 5. Stigmas distinct, or deeply lobed.
 - 6. Petals cleft, stamens 5..... (112) Dichapetalaceæ
 - 6. Petals not cleft; fruit a drupe.... (105) Erythroxylaceæ
 - 6. Petals not cleft: fruit not a drupe.
 - 7. Ovule 1 in each cell..... (135) Bombacaceæ
(*Cumingia*)
 - 7. Ovules 2 or more in each cell (136) Sterculiaceæ
 - 4. Filaments not forming a closed tube.
 - 5. Ovules 1. or 3 in each cell, styles distinct (114) Euphorbiaceæ
 - 5. Ovules 1 to 3 in each cell, styles more or less united.
 - 6. Style flattened and bent..... (112) Polygalaceæ
 - 6. Style not flattened and bent.
 - 7. Stamens twice as many as petals (67) Olacaceæ
(*Ximenia*)
 - 7. Petals 5, stamens 8..... (125) Aceraceæ
 - 7. Petals 5, stamens 6..... (126) Sapindaceæ
(*Aphania*)
 - 7. Stamens as many as petals.. (120) Celastraceæ
 - 5. Ovules numerous.
 - 6. Subshrubby weed, flowers yellow. (133) Tiliaceæ
(*Corchorus*)
 - 6. Montane shrubs (166) Clethraceæ
- 2. Leaves alternate, compound.
 - 3. Carpel 1; anthers opening by trap-doors..... (81) Berberidaceæ
 - 3. Carpel 1; anthers opening by slits.
 - 4. Fruit not fleshy.
 - 5. Stipules present (102) Leguminosæ
 - 5. Stipules none: stamens 10, equal..... (102) Leguminosæ
(*Prosopis*)
 - 5. Stipules none: stamens 5 or unequal.. (101) Connaraceæ
(*Connarus*)
 - 4. Fruit berry-like (110) Meliaceæ
 - 3. Carpels more than 1, distinct..... (101) Connaraceæ
 - 3. Carpels plural, ovaries distinct, styles united..... (108) Simarubaceæ
 - 3. Carpels plural, ovaries united.
 - 4. Leaves pinnate or ternate.
 - 5. Carpels 3, ovary 1-celled..... (118) Anacardiaceæ
(*Rhus*)
 - 5. Carpels 3, ovary 3-celled.
 - 6. Filaments united into a tube..... (110) Meliaceæ
 - 6. Filaments free unless at the base.. (126) Sapindaceæ
 - 5. Carpels 5, styles 5, divergent..... (103) Oxalidaceæ
 - 5. Carpels 5, styles 5, connivent or fused above (118) Anacardiaceæ
 - 5. Carpels more than 3, stigma sessile.
 - 6. Latex none (108) Simarubaceæ
(*Harrisonia* sp.)

- 6. Latex present (110) Meliaceæ
(*Lansium*)
 - 5. Carpels more than 3, style 1.
 - 6. Resin ducts in cortex none..... (110) Meliaceæ
 - 6. Resin ducts present in cortex.... (109) Burseraceæ
 - 4. Leaves palmate; carpels 3..... (126) Sapindaceæ
 - 4. Leaves palmate; carpels 4 to 5.
 - 5. Flowers minute (108) Simarubaceæ
(*Harrisonia* sp.)
 - 5. Flower large (135) Bombacaceæ
(*Ceiba*)
- D.**
- 1. Herbs with milky juice..... (89) Papaveraceæ
 - 1. Not herbs with latex; leaves compound.
 - 2. Carpel 1 (102) Leguminosæ
 - 2. Carpels more than 1, distinct.
 - 3. Scandent, without prickles..... (80) Ranunculaceæ
(*Clematis* sp.)
 - 3. Prickly, or not scandent..... (100) Rosaceæ
 - 2. Carpels more than 1, united.
 - 3. Flowers of moderate size, stamens free..... (91) Capparidaceæ
 - 3. Flowers large, stamens united..... (135) Bombacaceæ
(*Bombax*)
 - 1. Not herbs with milky juice; leaves simple, opposite..... (140) Guttiferæ
 - 1. Not herbs with latex; leaves simple, alternate.
 - 2. Carpel 1, oblique (100) Rosaceæ
 - 2. Carpel 1, regular; sepals deciduous (100) Rosaceæ
(*Pygeum*)
 - 2. Carpel 1, regular; sepals persistent.
 - 3. Herb (136) Sterculiaceæ
(*Waltheria*)
 - 3. Vine (137) Dilleniaceæ
(*Delima*)
 - 2. Carpel; 3, free and distinct (82) Menispermaceæ
(*Pycnarrhæna*)
 - 2. Carpels numerous, distinct (nearly so in Dillenia).
 - 3. Endosperm not cracked (83) Magnoliaceæ
 - 3. Endosperm cracked (84) Anonaceæ
 - 2. Carpels plural, ovaries distinct, style 1..... (138) Ochnaceæ
 - 2. Carpels plural, ovary compound.
 - 3. Petals attached to tube of united filaments.
 - 4. Anthers with 2 pollen sacs..... (134) Malvaceæ
 - 4. Anther with many pollen sacs (135) Bombacaceæ
(*Durio*)
 - 3. Stamens free from petals or not monadelphous.
 - 4. Styles 3 or 4; latex none..... (137) Dilleniaceæ
 - 4. Styles 2 or 3; latex present..... (114) Euphorbiaceæ
 - 4. Style none, or united at least at base; gynophore present (91) Capparidaceæ
(*Capparis*)
 - 4. Style none or more or less united: ovary sessile or stamens raised with it.
 - 5. Ovary with more than 1 cell.
 - 6. Fruit not a nut winged by the calyx.
 - 7. Carpels 3; stigma 2-lobed.. (132) Gonystylaceæ
 - 7. Stigma entire, or lobes as many as carpels.
 - 8. Stipules present, sometimes deciduous.
 - 9. Corolla valvate in bud.
 - 10. Petals cleft or fringed (131) Elæocarpaceæ
 - 10. Petals entire.. (133) Tiliaceæ
(*Muntingia*)

- 9. Corolla twisted
in bud, or petals too small.. (136) Sterculiaceæ
- 8. Stipules wanting (138) Theaceæ
- 6. Fruit a 1-seeded nut, carried by
segments of calyx (141) Dipterocarpaceæ
- 5. Ovary 1-celled.
- 6. Fruit a prickly capsule..... (143) Bixaceæ
- 6. Fruit indehiscent, smooth..... (145) Flacourtiaceæ

E.

- 1. Plants with fleshy stems and no green leaves..... (150) Cactaceæ
- 1. Stems sometimes fleshy; green leaves present, oblique; flowers
diclinous (149) Begoniaceæ
- 1. Stems rarely fleshy; leaves green, and equilateral or flowers
perfect.
- 2. Ovules more than 1 in each cell; herbs.
- 3. Ovary 1-celled (76) Portulacaceæ
- 3. Ovary with more than 1 cell.
- 4. Leaves 3- to 6-nerved, or petals 3..... (160) Melastomataceæ
- 4. Leaves with midrib; petals 4..... (161) Onagraceæ
- 2. Ovules more than 1 in each cell; woody plants.
- 3. Oil glands present in foliage..... (159) Myrtaceæ
- 3. Oil glands wanting; leaves alternate.
- 4. Ovary 1-celled.
- 5. Flowers perfect; vines (67) Olacaceæ
(*Erythralium*)
- 5. Flowers perfect; trees.
- 6. Inflorescence corymbose or nearly
so (100) Rosaceæ
- 6. Inflorescence a deep panicle..... (145) Flacourtiaceæ
(*Homalium*)
- 5. Flowers dioecious (148) Datisceæ
- 4. Ovary with 2 to 4 cells.
- 5. Stamens as many as petals, opposite
them (67) Olacaceæ
(*Strombosia*)
- 5. Stamens more numerous than petals.
- 6. Anthers basifixed (139) Theaceæ
(*Mountainorrisia*)
- 6. Anthers versatile (156) Lecythidaceæ
- 3. Oil glands wanting; leaves opposite.
- 4. Ovary 1-celled; stamens 4 (96) Saxifragaceæ
(*Polyosma*)
- 4. Ovary 1-celled; stamens more than 4.
- 5. Anthers not tailed.
- 6. Stipules present (157) Rhizophoraceæ
- 6. Stipules none (158) Combretaceæ
- 5. Anthers tailed (160) Melastomataceæ
- 4. Ovary with more than 1 cell; styles distinct.. (96) Saxifragaceæ
- 4. Ovary with more than 1 cell; styles united.
- 5. Leaves with single midribs.
- 6. Stipules present (157) Rhizophoraceæ
- 6. Stipules none.
- 7. Flowers without bracts..... (154) Sonneratiaceæ
- 7. Flowers with bracts (155) Punicaceæ
- 5. Leaves with several main nerves..... (160) Melastomataceæ
- 2. Ovule 1 in each cell; herbs.
- 3. Flowers not in umbels (162) Halorrhagidaceæ
- 3. Flowers in umbels; carpels 2..... (164) Umbelliferae
- 2. Ovule 1 in each cell; woody plants.
- 3. Stipules or sheath present.
- 4. Leaves simple, entire or nearly so..... (129) Rhamnaceæ
- 4. Leaves deeply divided or compound..... (163) Araliaceæ
- 3. Neither stipules nor sheath present..... (165) Cornaceæ

Sympetalæ.

1. Perianth hypogynous; styles 2, stigmas combined; juice milky.. (180) Asclepiadaceæ
1. Perianth hypogynous; stigmas distinct if the styles are so.
 2. Stamens free from corolla.
 3. Leaf axil without thorns.
 4. Flowers declinous; mostly vines.
 5. Stamens grown together; fruit 1-seeded (82) Menispermaceæ
 5. Stamens distinct; fruit symmetrical.. (124) Icacinaceæ
 4. Flowers perfect; not vines.
 5. Ovary 1-celled, calyx viscid..... (171) Plumbaginaceæ
(*Plumbago*)
 5. Ovary incompletely septate (97) Pittosporaceæ
 5. Ovary completely septate..... (167) Ericaceæ
 3. Leaf axils bearing thorns..... (176) Salvadoraceæ
 2. Stamens epipetalous, opposite lobes or more numerous.
 3. Carpels plural, free or nearly so..... (95) Crassulaceæ
 3. Carpels 1, or united.
 4. Herbs; fruit many-seeded..... (170) Primulaceæ
 4. Herbs; fruit 1-seeded (171) Plumbaginaceæ
 4. Woody plants; ovary 1-celled.
 5. Latex none; leaves undivided..... (169) Myrsinaceæ
 5. Latex copious; leaves palmately divided (147) Caricaceæ
 4. Woody plants; ovary with more than 1 cell.
 5. Style none or 1.
 6. Ovary 2-celled; corolla inconspicuous (151) Thymelæaceæ
 6. Cells more numerous; latex present (172) Sapotaceæ
 5. Styles distinct unless at base..... (173) Ebenaceæ
 2. Stamens epipetalous, alternate with lobes of regular corolla, but less numerous (175) Oleaceæ
 2. Stamens epipetalous, alternate with lobes and as numerous if corolla is regular.
 3. Alpine shrubs; carpels 5, style long..... (168) Epacridaceæ
 3. Not alpine shrubs with 5 carpels and long style.
 4. Juice milky.
 5. Shrubs or trees..... (179) Apocynaceæ
 5. Herbs or scandent plants.
 6. Seed numerous (179) Apocynaceæ
 6. Seed few, usually 2 in a carpel.. (181) Convolvulaceæ
 4. Latex absent.
 5. Fruit not composed of 2 to 4 1-seeded nutlets.
 6. Aquatics, immersed or floating.
 7. Leaves round-cordate, large (178) Gentianaceæ
 7. Leaves lacerate or minute.. (191) Lentibulariaceæ
 6. Not aquatic; leaves opposite.
 7. Stipules present, or indicated by lines joining leaves (177) Loganiaceæ
 7. Stipules entirely wanting.
 8. Flower regular; seed many.
 9. Corolla wheel-shaped (186) Scrophulariaceæ
(*Scoparia*)
 9. Corolla with a tube (178) Gentianaceæ
 8. Flower regular; seed few (183) Verbenaceæ
 8. Flower irregular; ovary 1-celled.
 9. Stamens as many as corolla lobes..... (178) Gentianaceæ

- 9. Stamens fewer than corolla lobes (190) Gesneriaceæ
- 8. Flower irregular; ovary with 2 or more cells.
 - 9. Seed few, rarely 8 in a cell.
 - 10. Fruit not a loculicidal capsule (183) Verbenaceæ
 - 10. Fruit a loculicidal capsule (192) Acanthaceæ
 - 9. Seed many.
 - 10. Herbs, or one a low shrub.. (186) Scrophulariaceæ
 - 10. Woody vines or trees .. (187) Bignoniaceæ
- 6. Not aquatic; leaves alternate or wanting.
 - 7. Flowers regular.
 - 8. Leaves radical; flowers in spikes..... (193) Plantaginaceæ
 - 8. Leaves not a radical cluster.
 - 9. Fruit few-seeded, dry (181) Convolvulaceæ
 - 9. Fruit many-seeded or a berry.
 - 10. Ovary 4- or more celled; style short or none.... (119) Aquifoliaceæ
 - 10. Ovary 2-celled or style long (185) Solanaceæ
 - 7. Flower irregular; parasites (189) Orobanchaceæ
 - 7. Flower irregular; trees..... (187) Bignoniaceæ
 - 7. Flower irregular; not parasites nor trees.
 - 8. Ovary 1-celled (190) Gesneriaceæ
 - 8. Ovary 2- or 4-celled.
 - 9. Stamens 5 (185) Solanaceæ
 - 9. Stamens 4.
 - 10. Endo-sperm present (186) Scrophulariaceæ
 - 10. Endo-sperm absent (188) Pedaliaceæ
- 5. Fruit composed of 1-seeded nutlets.
 - 6. Leaves alternate; carpels 2, ovules 4 (182) Boraginaceæ
 - 6. Leaves alternate; carpels 3, ovules 3 (122) Stackhousiaceæ
 - 6. Leaves opposite.

- 7. Style on apex of ovary..... (183) Verbenaceæ
- 7. Style sunk between lobes of ovary (184) Labiatæ
- 1. Perianth perigynous or epigynous.
 - 2. Anthers not connivent.
 - 3. Juice milky (179) Apocynaceæ
 - 3. Latex wanting; leaves alternate.
 - 4. Without ovary; pistillate flower polypetalous (124) Icacinaceæ
(*Miquelia*)
 - 4. Ovary 1-celled (169) Myrsinaceæ
 - 4. Ovary with more than 1 cell.
 - 5. Seed many (167) Ericaceæ
 - 5. Seed few (174) Symplocaceæ
 - 3. Latex wanting; leaves opposite, compound..... (195) Caprifoliaceæ
(*Sambucus*)
 - 3. Latex wanting; leaves opposite, simple.
 - 4. Stipules wanting (195) Caprifoliaceæ
 - 4. Stipules present (194) Rubiaceæ
 - 2. Anthers connivent or fused.
 - 3. Flowers not in dense heads.
 - 4. Stamens and pistil distinct.
 - 5. Vines with tendrils..... (196) Cucurbitaceæ
 - 5. Scandent woody or half-woody plants.
 - 6. Flower regular (197) Campanulaceæ
 - 6. Flower zygomorphic (198) Goodeniaceæ
(*Scaevola sp.*)
 - 5. Herbs, not vines.
 - 6. Style not branched..... (197) Campanulaceæ
 - 6. Style forked (198) Goodeniaceæ
(*Calogyne*)
 - 5. Tree or shrub, fruit a berry..... (198) Goodeniaceæ
(*Scaevola sp.*)
 - 4. Stamens and pistil united, forming a column (198a) Stylidiaceæ
 - 3. Flowers in dense heads..... (199) Compositæ

LIST OF PHILIPPINE PLANT FAMILIES.

- | | |
|----------------------------|-----------------------|
| 1. Marattiaceæ. | 47. Zingiberaceæ. |
| 2. Ophioglossaceæ. | 48. Cannaceæ. |
| 3. Hymenophyllaceæ. | 49. Marantaceæ. |
| 4. Cyatheaceæ. | 50. Burmanniaceæ. |
| 5. Polypodiaceæ. | 51. Orchidaceæ. |
| 6. Parkeriaceæ. | |
| 7. Gleicheniaceæ. | 52. Casuarinaceæ. |
| 8. Schizæaceæ. | 53. Saururaceæ. |
| 9. Osmundaceæ. | 54. Piperaceæ. |
| 10. Marsileaceæ. | 55. Chloranthaceæ. |
| 11. Salviniaceæ. | 56. Salicaceæ. |
| 12. Lycopodiaceæ. | 57. Myricaceæ. |
| 13. Psilotaceæ. | 58. Juglandaceæ. |
| 14. Selaginellaceæ. | 59. Fagaceæ. |
| 15. Equisetaceæ. | 60. Ulmaceæ. |
| | 61. Moraceæ. |
| 16. Cycadaceæ. | 62. Urticaceæ. |
| 17. Taxaceæ. | 63. Proteaceæ. |
| 18. Pinaceæ. | 64. Loranthaceæ. |
| 19. Gnetaceæ. | 65. Santalaceæ. |
| | 66. Opiliaceæ. |
| 20. Typhaceæ. | 67. Olacaceæ. |
| 21. Pandanaceæ. | 68. Balanophoraceæ. |
| 22. Potamogetonaceæ. | 69. Aristolochiaceæ. |
| 23. Naiadaceæ. | 70. Rafflesiaceæ. |
| (<i>Aponogetonaceæ.</i>) | 71. Polygonaceæ. |
| 25. Alismataceæ. | 72. Chenopodiaceæ. |
| 26. Hydrocharitaceæ. | 73. Amarantaceæ. |
| 27. Triuridaceæ. | 74. Nyctaginaceæ. |
| 28. Gramineæ. | 75. Aizoaceæ. |
| 29. Cyperaceæ. | 76. Portulacaceæ. |
| 30. Palmæ. | 77. Basellaceæ. |
| 31. Araceæ. | 78. Caryophyllaceæ. |
| 32. Lemnaceæ. | 79. Nymphæaceæ. |
| 33. Flagellariaceæ. | 79a. Ceratophyllaceæ. |
| 33a. Centrolepidaceæ. | 80. Ranunculaceæ. |
| 34. Xyridaceæ. | 81. Berberidaceæ. |
| 35. Eriocaulaceæ. | 82. Menispermaceæ. |
| 36. Bromeliaceæ. | 83. Magnoliaceæ. |
| 37. Commelinaceæ. | 84. Anonaceæ. |
| 38. Pontederiaceæ. | 85. Myristicaceæ. |
| (<i>Philydraceæ.</i>) | 86. Monimiaceæ. |
| 39. Juncaceæ. | 87. Lauraceæ. |
| 40. Stemonaceæ. | 88. Hernandiaceæ. |
| 41. Liliaceæ. | 89. Papaveraceæ. |
| 42. Amaryllidaceæ. | 90. Cruciferae. |
| 43. Taccaceæ. | 91. Capparidaceæ. |
| 44. Dioscoreaceæ. | 92. Moringaceæ. |
| 45. Iridaceæ. | 93. Nepenthaceæ. |
| 46. Musaceæ. | 94. Droseraceæ. |

95. Crassulaceæ.
96. Saxifragaceæ.
97. Pittosporaceæ.
98. Cunoniaceæ.
99. Hamamelidaceæ.
100. Rosaceæ.
101. Connaraceæ.
102. Leguminosæ.
103. Oxalidaceæ.
104. Tropæolaceæ.
105. Erythroxylaceæ.
106. Zygophyllaceæ.
107. Rutaceæ.
108. Simarubaceæ.
109. Burseraceæ.
110. Meliaceæ.
111. Malpighiaceæ.
112. Polygalaceæ.
113. Dichapetalaceæ.
114. Euphorbiaceæ.
115. Callitrichaceæ.
116. Buxaceæ.
117. Coriariaceæ.
118. Anacardiaceæ.
119. Aquifoliaceæ.
120. Celastraceæ.
121. Hippocrateaceæ.
122. Stackhousiaceæ.
123. Staphyleaceæ.
124. Icacinaceæ.
125. Aceraceæ.
126. Sapindaceæ.
127. Sabiaceæ.
128. Balsaminaceæ.
129. Rhamnaceæ.
130. Vitaceæ.
131. Elæocarpaceæ.
132. Gonystylaceæ.
133. Tiliaceæ.
134. Malvaceæ.
135. Bombacaceæ.
136. Sterculiaceæ.
137. Dilleniaceæ.
138. Ochnaceæ.
139. Theaceæ.
140. Guttiferæ.
141. Dipterocarpaceæ.
142. Elatinaceæ.
143. Bixaceæ.
144. Violaceæ.
145. Flacourtiaceæ.
146. Passifloraceæ.
147. Caricaceæ.
148. Datisceæ.
149. Begoniaceæ.
150. Cactaceæ.
151. Thymelæaceæ.
152. Elæagnaceæ.
153. Lythraceæ.
154. Sonneratiaceæ.
155. Punicaceæ.
156. Lecythidaceæ.
157. Rhizophoraceæ.
158. Combretaceæ.
159. Myrtaceæ.
160. Melastomataceæ.
161. Onagraceæ.
162. Halorrhagidaceæ.
163. Araliaceæ.
164. Umbelliferæ.
165. Cornaceæ.
166. Clethraceæ.
167. Ericaceæ.
168. Epacridaceæ.
169. Myrsinaceæ.
170. Primulaceæ.
171. Plumbaginaceæ.
172. Sapotaceæ.
173. Ebenaceæ.
(*Styracaceæ.*)
174. Symplocaceæ.
175. Oleaceæ.
176. Salvadoraceæ.
177. Loganiaceæ.
178. Gentianaceæ.
179. Apocynaceæ.
180. Asclepiadaceæ.
181. Convolvulaceæ.
182. Borraginaceæ.
183. Verbenaceæ.
184. Labiatæ.
185. Solanaceæ.
186. Scrophulariaceæ.
187. Bignoniaceæ.
188. Pedaliaceæ.
(*Martyniaceæ.*)
189. Orobanchaceæ.
190. Gesneriaceæ.
191. Lentibulariaceæ.
192. Acanthaceæ.
193. Plantaginaceæ.
194. Rubiaceæ.
195. Caprifoliaceæ.
196. Cucurbitaceæ.
197. Campanulaceæ.
198. Goodeniaceæ.
- 198a. Stylidiaceæ.
199. Compositæ.

